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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

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U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/509649

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

INTERNATIONAL APPLICATION NO.
PCT/AU98/00821INTERNATIONAL FILING DATE
30 September 1998PRIORITY DATE CLAIMED
02 October 1997TITLE OF INVENTION
MICROGRAPHIC DEVICE

APPLICANT(S) FOR DO/EO/US

Robert Arthur LEE et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. has been transmitted by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/US).
6. A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. have been transmitted by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has NOT expired.
 - d. have not been made and will not be made.
8. A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. A **FIRST** preliminary amendment.
- A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. A substitute specification.
15. A change of power of attorney and/or address letter. (Appointment of Associate Attorney)
16. Other items or information:

Express Mail Label No.
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17. The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :**

Neither international preliminary examination fee (37 CFR 1.482)
 nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO
 and International Search Report not prepared by the EPO or JPO \$970.00

International preliminary examination fee (37 CFR 1.482) not paid to
 USPTO but International Search Report prepared by the EPO or JPO \$840.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but
 international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$690.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)
 but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)
 and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00

CALCULATIONS PTO USE ONLY**ENTER APPROPRIATE BASIC FEE AMOUNT =**

\$ 970.00

Surcharge of \$130.00 for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	18 - 20 =	0	X \$18.00	\$
Independent claims	3 - 3 =	0	X \$78.00	\$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$ 260.00
TOTAL OF ABOVE CALCULATIONS =				\$ 1230.00
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$
SUBTOTAL =				\$ 1230.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$
				+
TOTAL NATIONAL FEE =				\$ 1230.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				+
				\$ 40.00
TOTAL FEES ENCLOSED =				\$ 1270.00
				Amount to be refunded: \$
				charged: \$

a. A check in the amount of \$ 1,270.00 to cover the above fees is enclosed.

- b. Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-0400. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Ladas & Parry
 224 South Michigan Avenue
 Chicago, Illinois 60604
 (312) 427-1300

March 30, 2000

Make a copy of this sheet



SIGNATURE:

Thomas F. Peterson

NAME:

24790

REGISTRATION NUMBER:

09/509649
480 Rec'd PCT/PTO 30 MAR 2000

DOCKET: CU-2137

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: Robert Arthur LEE et al)
TITLE: MICROGRAPHIC DEVICE)
COMPLETION OF PCT/AU98/00821 filed 30 September 1998)

The Assistant Commissioner for Patents (DO/EO/US)
Box PCT
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the application being filed herewith under 35 USC 371.

IN THE CLAIMS:

Please cancel claims 1-18 and substitute new claims 19-36 as follows:

19. A device having a surface relief structure which has a plurality of regions,

wherein the regions include grey scale regions which are too small to be separately resolvable to the human eye,

each grey scale region being one of a limited number of different grey scale region structure types,

the different grey scale region structure types appearing, by reason of their differing diffuse scattering characteristics, to have different intensities when the device is illuminated by a light source and viewed by an observer from any direction.

20. A device according to claim 19, wherein each grey scale region structure type has one or more graphic elements, line art or text images represented in microscopic size in its surface relief structure.

21. A device according to claim 20, wherein each microscopic region is of size 120 micron by 120 micron or less.

22. A device according to claim 20, wherein the same image is represented in each grey scale region structure type, but with differing diffuse scattering characteristics.

23. A device according to claim 20, wherein different graphic elements

line art or images are represented in different grey scale region structure types.

24. A device having a surface relief structure which has a regular array of regions, each region being too small to be separately resolvable to the human eye, wherein a large number of the regions are micrographic regions with diffuse scattering characteristics, each micrographic region having one or more graphic elements, line art or text images presented in microscopic size in its surface relief structure so that each micrographic region appears to an observer to be a particular shade of grey when viewed from any direction.

25. A device according to claim 24, wherein each micrographic region has an identical image represented in its surface relief structure.

26. A device according to claim 24, wherein each micrographic region has a structure which is one of a limited number of micrographic region structure types.

27. A device according to any one of claims 19 to 26 wherein, when the device is illuminated by a light source and viewed by an observer, the observer sees in microscopic form an image which corresponds with a microscopic image represented in the surface relief structure of some or all of the regions.

28. A device according to any one of claims 19 to 27 further including a plurality of diffracting regions such that, upon illumination by a light source, the device generates one or more diffraction images which are observable from one or more ranges of viewing angles around the device.

29. A device according to claim 28, wherein non-diffracting regions provide a contrast-enhancing dark background to the diffraction image or images.

30. A device according to claim 28, wherein non-diffracting regions provide grey scale enhancement to the diffraction image or images.

31. A device according to claim 20 or claim 24 wherein some or all of the regions are hybrid regions which include both periodic surface structure which has diffractive effects and graphic elements line art or images which have diffuse scattering effects.

32. A device according to claim 31, wherein microscopic text is embossed onto or engraved into the tops of diffractive periodic surface structure elements and/or between diffractive periodic surface structure elements.

33. A device having a surface relief structure which has a plurality of light scattering regions, each region having a number of structures which scatter incident light in different directions, so that the region appears to an observer to be a particular shade of grey when viewed from any direction.

34. A valuable document incorporating a device according of any one of claims 19 to 33 wherein printing on the valuable document matches up with, and appears to be continuous with regions on the device which have a printed appearance.

35. A device according to any one of claims 19 to 33 which is used for authentication purposes, wherein authentication of the device takes place by microscopic examination and recognition of the regions.

36. A device according to any one of claims 19 to 33 which is used for authentication purposes, wherein authentication of the device takes place by machine recognition of the regions.

REMARKS

The aforesaid claims are based on the claims from the International Preliminary Examination Report.

Respectfully submitted,

March 30, 2000
Date


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MICROGRAPHIC DEVICE

- This invention relates to a micrographic device. It relates particularly but not exclusively to a security device which generates a grey scale image when illuminated by a light source and viewed by an observer, and to an authentication device which incorporates graphic elements line art or images represented in microscopic size in repeated regions of its surface relief structure. The device may be used in a number of different applications, and it has particular applicability as an anti-forgery security device on bank notes, credit cards, cheques, share certificates and other similar documents.
- Recent improvements in reproduction technology have made it easier for a person to forge a copy of a valuable document. Various different types of security devices are available to protect against copying. One such type of security device is a hologram of the type which has been applied to VISA™ and MasterCard™ credit cards since 1984. When viewed under appropriate illumination conditions (best seen with a point light source such as a single incandescent globe), holograms generate an image which appears to change as the angle of observation changes. When not illuminated, the hologram has a silver appearance. Holograms provide protection against colour photocopying and similar reproductive techniques because such reproductive techniques cannot reproduce the ability to generate images which differ when viewed from different angles.

Holograms are a member of a class of security devices referred to as optically variable devices (OVDs). Newer and more secure optically variable devices have been developed, including dot matrix hologram technology (EP0 467 601 A2), KINEGRAM™ technology (EP105099, EP330738, EP375833) as first used on the Saudi Arabia passport in 1987 and later on the Austrian 5000 Schilling bank note in 1990, CATPIX™ grating technology (PCT/AU89/ 00542) used on the Australian plastic ten dollar bank note issued in 1988 and the Singapore plastic 50 dollar bank note in 1990, PIXELGRAM™ diffraction technology (PCT/AU90/00395, US patent 5428479) and EXELGRAM™ diffraction technology (PCT/AU94/00441) which appeared on Australian opal stamps and Vietnam bank cheques issued in 1995 and on AMEX™ travellers cheques and Hungarian bank notes in 1997.

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The contents of International patent applications PCT/AU90/00395 and PCT/AU94/00441, both in the name of the present applicant, are hereby incorporated herein by reference.

OVDs typically consist of a thin layer of a metallised foil applied by 5 means of an adhesive to a substrate. A typical OVD appears silver in colour, and this can adversely affect the contrast in images viewed by an observer.

Rough treatment of a document bearing an OVD can result in substantial diminution in the optically variable effects produced by the OVD, with a resulting reduction in the degree of security afforded.

10 Most OVDs can be simulated to some extent by holographic copying techniques. While holographic copying equipment is not as readily available as colour photocopiers, the technology is available to the determined forger. Simulations made using holographic copying typically do not incorporate all of the security features of original OVDs, and they typically have a lower quality, 15 but they are often of sufficient quality to mislead unsuspecting members of the public. It is therefore desirable for security devices copied by holographic techniques to be obviously different from the original.

It is an object of the present invention to provide some improvements in security device technology.

20 According to one aspect of the present invention, there is provided a device having a surface relief structure which has a plurality of light scattering regions, each region having a number of structures which scatter incident light in different directions, so that the region appears to an observer to be a particular shade of grey. This allows the device to simulate an optically 25 invariable "printed" appearance, which is not capable of being copied by holographic techniques.

The particular shade of brown or grey generated by a light scattering region is dependent upon the number of scattering centres and feature sizes of those scattering centres within a given surface area.

30 The particular resolution of the "printed" appearance depends upon the size of each scattering region. It is preferred although not necessary that the regions be too small to be separately discernible to the unassisted human eye. It is preferred that each region is of size 120 micron by 120 micron or less.

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It is preferred that the device include both diffractive surface relief structure regions and scattering regions, so that, under appropriate illumination conditions, both optically variable effects and "printed"-type effects can be seen by the observer.

5 Where the device is a foil applied to the surface of a valuable document such as a bank note, the "printed" effects caused by the scattering regions can be made to line up with and complement the printed effects such as guilloche effects on the rest of the valuable document. This gives the device a more integrated appearance with the rest of the document, rather than the separate
10 "appended" appearance of a typical OVD.

According to another aspect of the invention, there is provided a device having a surface relief structure which has a plurality of regions, wherein the regions include grey scale regions which are too small to be separately resolvable to the human eye, each grey scale region being one of a limited
15 number of different grey scale region structure types, the different grey scale region structure types appearing, by reason of the differing diffuse scattering characteristics, to have different intensities when the device is illuminated by a light source and viewed by an observer.

As a preferred feature, one or more of the grey scale region structure
20 types may have one or more graphic elements, line art or images represented in microscopic size in their surface relief structures. This results in multiple replication of the graphic elements line art or images across the device, making it impossible to destroy all copies by reason of rough usage.

In this preferred form, the same image may be represented in each grey
25 scale region structure type, but with differing diffuse scattering characteristics. Alternatively, different graphic elements, line art or images may be represented in the different grey scale region structure types.

According to another aspect of the invention there is provided a device having a surface relief structure which has a regular array of regions, each
30 region being too small to be separately resolvable to the human eye, wherein a large number of the regions are micrographic regions, each micrographic region having one or more graphic elements, line art or images represented in microscopic size in its surface relief structure.

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In some embodiments, each micrographic region may have an identical image represented in its surface relief structure. In other embodiments, each micrographic region may have a structure which is one of a limited number of micrographic region structure types.

5 Some embodiments may be constructed in such a way that, when the device is illuminated by a light source and viewed by an observer, the observer sees in macroscopic form an image which corresponds with a microscopic image represented in the surface relief structure of some or all of the regions.

It is preferred that the device also be an optically variable device.

10 In a preferred form, the device includes a plurality of diffracting regions such that, upon illumination by a light source, the device generates one or more diffraction images which are observable from one or more ranges of viewing angles around the device. Non-diffracting regions may provide a contrast enhancing dark background to the diffraction image or images.

15 Alternatively, non-diffracting regions may provide grey scale enhancements to the diffraction image or images.

In some embodiments, some or all of the regions may be hybrid regions which include both periodic surface structure which has diffractive effects and graphic elements, line art or images which have diffuse scattering effects.

20 In some embodiments, regular arrays of alpha numeric characters or similar size graphics can be used to generate an optical effect which includes both diffractive and diffuse scattering components.

25 Microscopic text may be embossed onto or engraved into the tops of diffractive periodic surface structure elements and/or between diffractive periodic surface structure elements, in order to give an additional authentication feature.

The inventive device is particularly useful for authentication purposes. Authentication of the device may take place by microscopic examination and recognition of the regions. Alternatively, authentication of the device may take 30 place by machine recognition of the regions.

The invention will hereafter be described in greater detail with reference to the attached drawings which show example forms of the invention. It is to be

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understood that the particularity of those drawings does not supersede the generality of the preceding description of the invention.

Figure 1 is a schematic diagram illustrating the operation of the invention.

5 Figure 2 is a sample line art image which, when applied in microscopic format to the surface relief structure of a device creates a suitable region for use in accordance with the invention.

Figure 3 shows the trapezoidal shapes used to generate the image of Figure 2.

10 Figure 4 shows some numerals which are suitable for use in the same manner.

Figure 5 shows some graphics which are suitable for use in the same manner.

15 Figure 6 shows the rectangular shapes used to generate the image of Figure 5.

Figure 7 shows some graphics which are suitable for use in the same manner.

Figure 8 shows some writing which is suitable for use in the same manner.

20 Referring now to Figure 1, there is shown device 1 having surface relief structure 2 which has a plurality of regions 3. Regions 3 include grey scale regions 4, which are too small to be separately resolvable to the human eye. (They are shown in much magnified state in Figure 1). Each grey scale region 4 is one of a limited number of different grey scale region structure types. The 25 different grey scale region structure types appear, by reason of their differing diffuse scattering characteristics, to have different intensities when device 1 is illuminated by light source 5 and viewed by an observer 6.

The grey scale region structure types may be developed by selecting a limited number of diffuse scattering structures, each of which has different 30 scattering characteristics. A diffuse scattering structure may be created randomly. However, most graphic elements, line art drawings and images naturally possess diffuse scattering characteristics, and it is a preferred feature of the present invention that the diffuse scattering regions use relief structures

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which incorporate graphic elements such as alpha numeric characters or recognisable shapes, line art drawings, or other images. The use of such recognisable images in the diffuse scattering regions adds to the security of the device in that of authenticity of the device can be checked by microscopic
5 examination of the diffuse scattering regions.

Although a single image has predetermined scattering characteristics, and hence a predetermined grey scale intensity value, the diffusion characteristics and grey scale value can be altered by altering such features as depth of the surface relief structure, sharpness of the surface relief structure
10 profile, and introduction or removal of random "noise" structures by varying the number of scattering centres and feature sizes of the scattering centres within the region. It is therefore possible to use the same image to generate all of the different grey scale region structure types.

It is of course not necessary to use the same image in each grey scale
15 region, and different grey scale region structure types may use different images.

As stated above, the grey scale regions are too small to be separately resolvable to the human eye. For a normal human eye, the smallest resolvable structure has a width of about 0.25mm. Any size below this is suitable,
20 although the presently preferred size is a region approximately 30 micron x 30 micron. It is not necessary that the region be square; it may be hexagonal, circular, or any other suitable shape. In International Application PCT/AU94/00441 there is extensive discussion concerning the merits of using long narrow strips, rather than small squares. It is also possible for the surface
25 relief structure to be substantially continuous, so that there is no clearly discernible separation between notional adjoining surface regions.

In a special case of the present invention, the microscopic image produced by the device upon illumination may be the same image as the microscopic image which is represented in the surface relief structure of some
30 or all of the regions. By way of example, Figure 2 shows a pigeon comprised of approximately 1,024 x 1,024 pixels. In an electron beam writing device operating at a high resolution, this corresponds with a surface region of approximately 30 micron x 30 micron. In a macroscopic image generated by

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- light illuminating a surface relief structure into which the microscopic pigeon shape has been embossed, the pigeon shape will be responsible for one tiny dark dot. When the pigeon shape has been embossed into a large number of different areas of the surface relief structure corresponding with the
- 5 macroscopic shape of the pigeon, wherein each embossing represents a single pixel of the macroscopic image, the result after illumination will be a macroscopic image of the pigeon. This is of course a special case, and the dark image dots created by individual pigeon shape embossing can be used to create any desired macroscopic image.
- 10 The image shown in Figure 2 began as a line art image. The line art image was converted by a mathematical conversion process into a group of geometrical figures, as shown in Figure 3, to facilitate engraving by the electron beam lithography process. The engraving process results in the image of Figure 2.

15 The graphics in Figure 4 consist of the numerals "50" arranged in a pattern, with the total pattern being of suitable resolution for transfer by electron beam lithography process onto a surface region of approximately 30 micron x 30 micron in size.

Figure 5 shows some more graphics comprised of the alphabetic letters
20 CSIRO, and the logo of the Commonwealth Scientific and Industrial Research Organisation. This art work also began as line art, which was converted into a pattern of rectangles as shown in Figure 6, to facilitate transfer by the electron beam lithography process to a surface relief structure region approximately 30 micron x 30 micron in size, resulting in the structure of Figure 5.

25 Figure 7 shows some more graphics comprised of alpha numeric symbols and other symbols and shapes, once again suitable for transfer by electron beam lithography to a surface region approximately 30 micron x 30 micron in size.

Figure 6 shows one of Shakespeare's sonnets written in dot-matrix style
30 letters within a square region. This text arrangement is suitable for transfer by electron beam lithography to a surface region approximately 30 micron by 30 micron in size.

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Device 1, in addition to grey scale regions 4, may include a plurality of diffracting regions 8, such that, upon illumination by light source 5, device 1 generates one or more diffraction images which are observable from one or more ranges of viewing angles 6 around the device. With this preferred feature, 5 the device acts as an optically variable device with the additional benefits of the present invention. The non-diffracting regions, which may include some or all of the grey scale regions 4 may provide a contrast-enhancing dark backgrounds to the diffraction image or images. As indicated previously, optically variable devices typically have a silver background, which may detract 10 from the contrast of the diffraction image generated. The use of diffusely scattering regions 4 results in a dark background, which enhances image contrast.

Further or alternatively, grey scale regions 4 may provide a grey scale enhancement to the diffraction image or images. This may be by way of 15 highlights, enhancements, an integral part of image, or a super imposed image.

The above description has proceeded on the assumption that diffracting surface regions are separate from diffusely scattering surface regions. However, it is possible that a single surface region may include both diffuse scattering and diffractive effects. A single region may be a hybrid region which 20 includes both periodic surface structure, which has diffractive effects, and graphic elements, line art or images which have diffuse scattering effects.

It is also possible to use regular arrays of alpha numeric characters or similar symbols to generate an optical effect which includes both diffractive and diffuse scattering components.

25 Micrographic surface structure regions according to the invention have a number of different practical applications including the following:

1. They can be used as an additional level security feature which can be checked using high speed microscopic machine vision systems.
2. The non-periodic structure of the micrographic regions means that 30 holographic or contact copying of the structures is impossible to achieve.
3. Because diffusely scattering micrographic regions are impossible to copy holographically, the differences in grey scale level of the micrographic grey scale elements become indistinguishable on a copied device and therefore any

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macroscopic graphic feature constructed out of at least two types of micrographic regions will be unobservable on the copied device.

4. Micrographic regions can therefore be used as a unique background optically invariable security feature on diffractive images originated using
5 electron beam lithography techniques.

5. Because individual micrographic surface structures appear many hundreds or even thousands of times as a background to the diffractive features of an OVD, the micrographic information possesses multiple redundancy and is available for microscopic identification and authentication
10 purposes even after severe scratching of the OVD foil.

6. Micrographic regions can be used as a contrast enhancing dark background to the diffractive features of an OVD so that the apparent brightness of the diffractive features is increased.

7. Micrographic regions can be used to make OVDs appear far less
15 metallic than normal metallised foil. The diffuse scattering effect of the micrographic regions is the source mechanism for this result.

It is to be understood that various alterations additions and/or modifications may be made to the parts previously described without departing from the ambit of the invention.

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Article
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CLAIMS

1. A device having a surface relief structure which has a plurality of regions, wherein the regions include grey scale regions which are too small to be separately resolvable to the human eye,
 - 5 each grey scale region being one of a limited number of different grey scale region structure types,
 - 10 the different grey scale region structure types appearing, by reason of their differing diffuse scattering characteristics, to have different intensities when the device is illuminated by a light source and viewed by an observer from any direction.
 2. A device according to claim 1 wherein each grey scale region structure type has one or more graphic elements, line art or text images represented in microscopic size in its surface relief structure.
 - 15 3. A device according to claim 2 wherein each microscopic region is of size 120 micron by 120 micron or less.
 4. A device according to claim 2 wherein the same image is represented in each grey scale region structure type, but with differing diffuse scattering characteristics.
 - 20 5. A device according to claim 2 wherein different graphic elements line art or images are represented in different grey scale region structure types.
 - 25 6. A device having a surface relief structure which has a regular array of regions, each region being too small to be separately resolvable to the human eye, wherein a large number of the regions are micrographic regions with diffuse scattering characteristics, each micrographic region having one or more graphic elements, line art or text images represented in microscopic size in its surface relief structure so that each micrographic region appears to an observer to be a particular shade of grey when viewed from any direction.

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7. A device according to claim 6 wherein each micrographic region has an identical image represented in its surface relief structure.
8. A device according to claim 6 wherein each micrographic region has a structure which is one of a limited number of micrographic region structure types.
9. A device according to any one of claims 1 to 8 wherein, when the device is illuminated by a light source and viewed by an observer, the observer sees in microscopic form an image which corresponds with a microscopic image represented in the surface relief structure of some or all of the regions.
10. A device according to any one of claims 1 to 9 further including a plurality of diffracting regions such that, upon illumination by a light source, the device generates one or more diffraction images which are observable from one or more ranges of viewing angles around the device.
11. A device according to claim 10 wherein non-diffracting regions provide a contrast-enhancing dark background to the diffraction image or images.
12. A device according to claim 10 wherein non-diffracting regions provide grey scale enhancement to the diffraction image or images.
13. A device according to claim 2 or claim 6 wherein some or all of the regions are hybrid regions which include both periodic surface structure which has diffractive effects and graphic elements line art or images which have diffuse scattering effects.
14. A device according to claim 13 wherein microscopic text is embossed onto or engraved into the tops of diffractive periodic surface structure elements and/or between diffractive periodic surface structure elements.

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15. A device having a surface relief structure which has a plurality of light scattering regions, each region having a number of structures which scatter incident light in different directions, so that the region appears to an observer to be a particular shade of grey when viewed from any direction.

5

16. A valuable document incorporating a device according to any one of claims 1 to 15 wherein printing on the valuable document matches up with, and appears to be continuous with regions on the device which have a printed appearance.

10

17. A device according to any one of claims 1 to 15 which is used for authentication purposes, wherein authentication of the device takes place by microscopic examination and recognition of the regions.

15

18. A device according to any one of claims 1 to 15 which is used for authentication purposes, wherein authentication of the device takes place by machine recognition of the regions.

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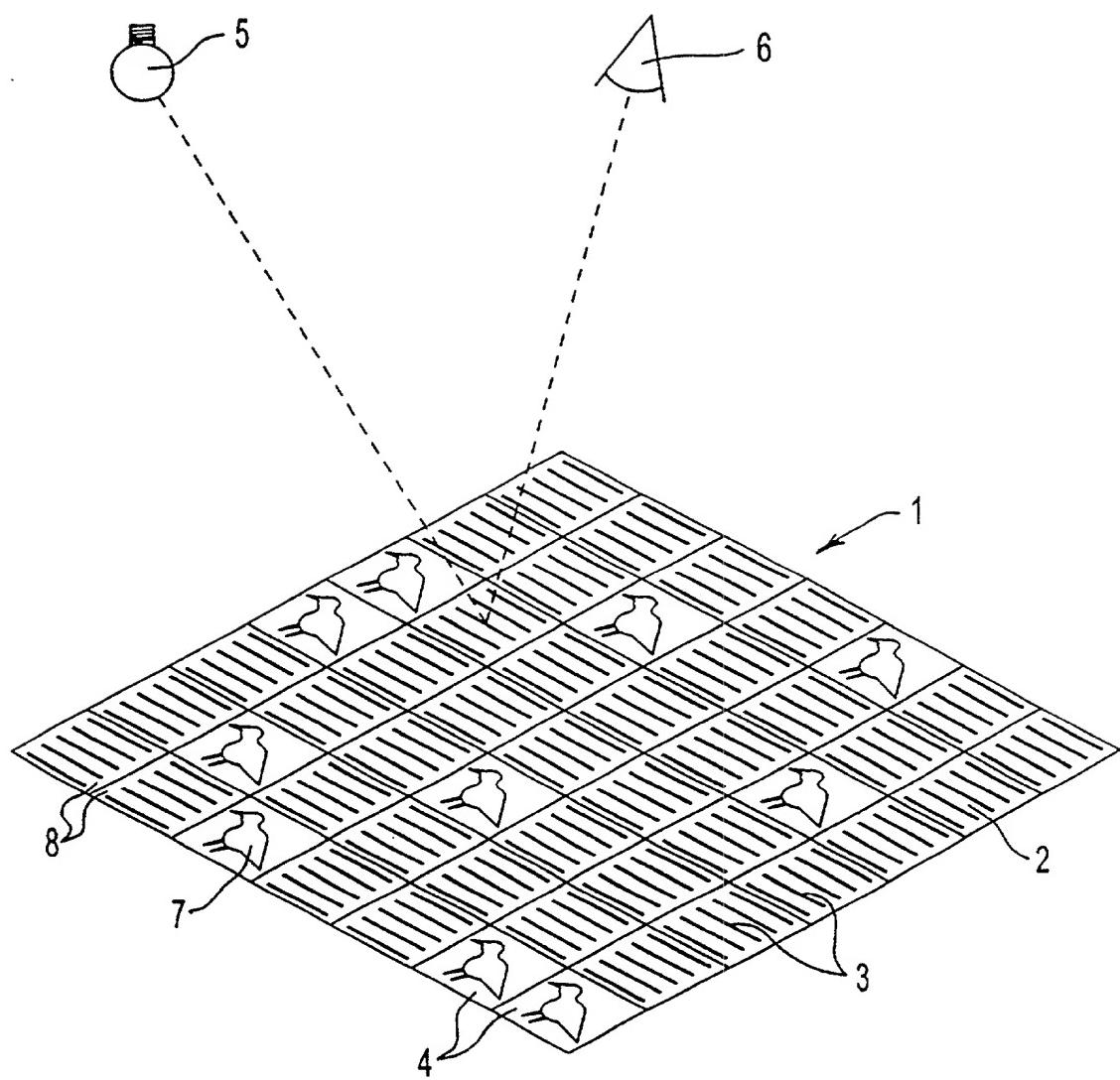


FIG 1

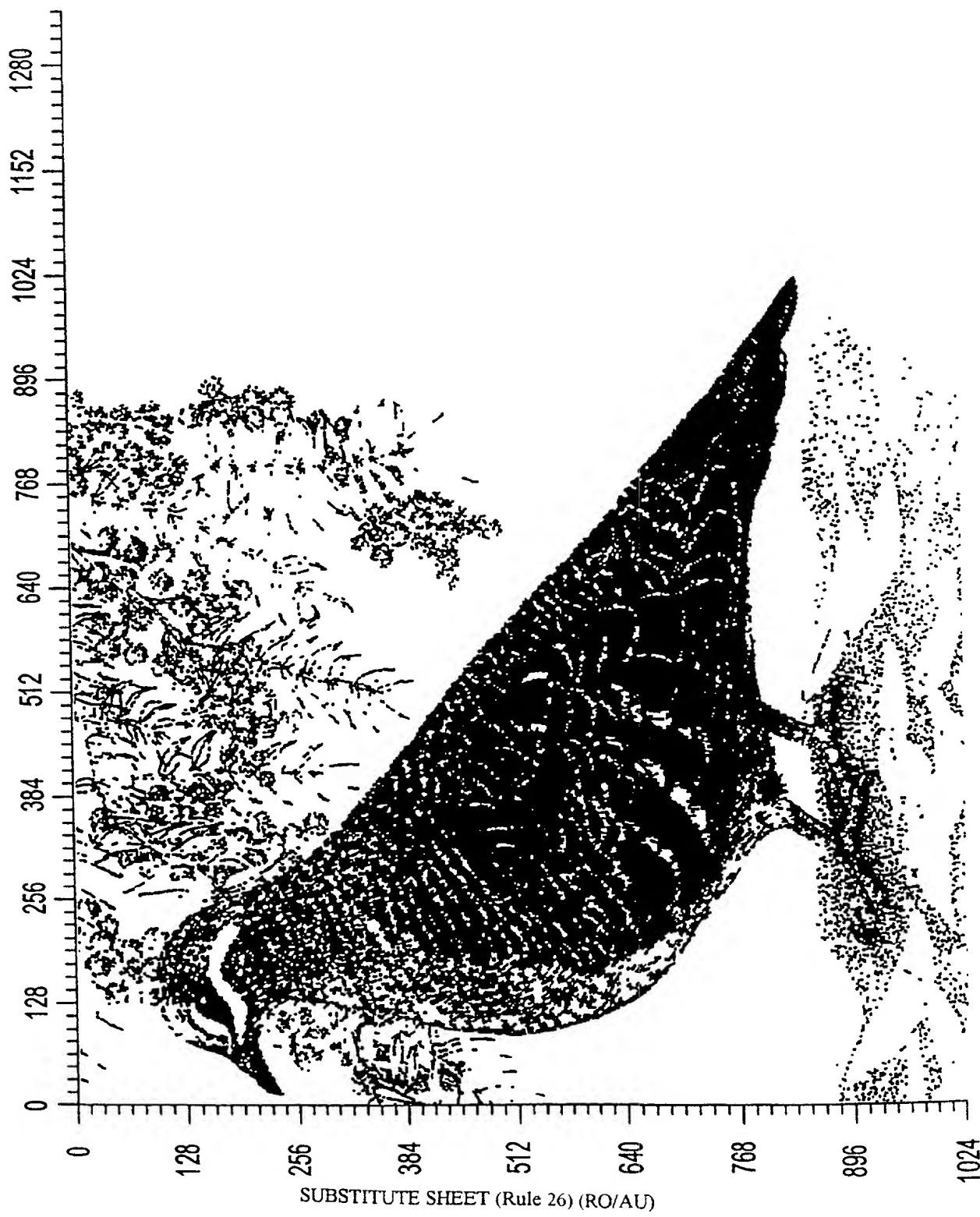
09/509649

WO 99/17941

PCT/AU98/00821

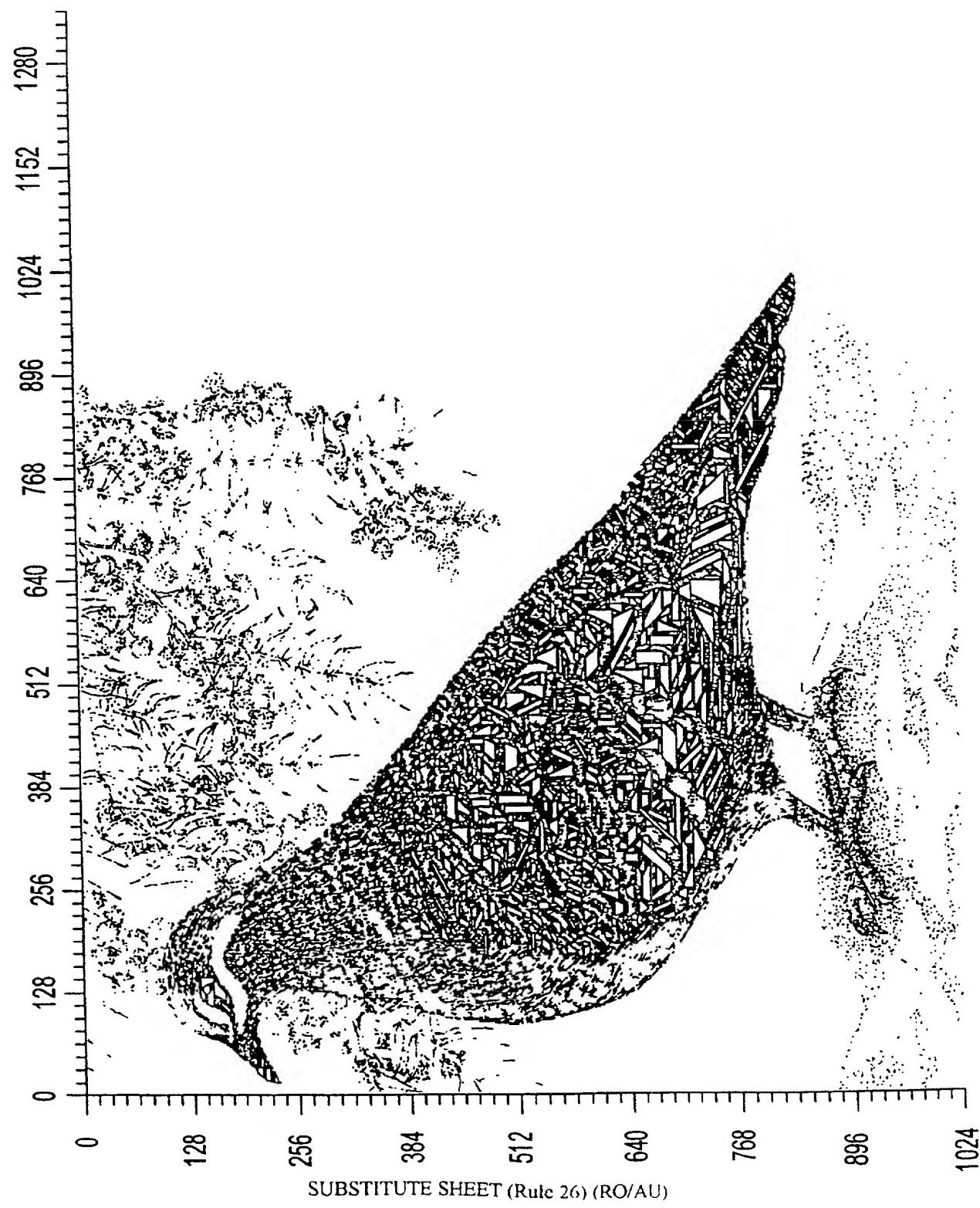
2/8

FIG 2



3/8

FIG 3



4/8

50 50 50
50 50
50 50 50
50 50

FIG 4

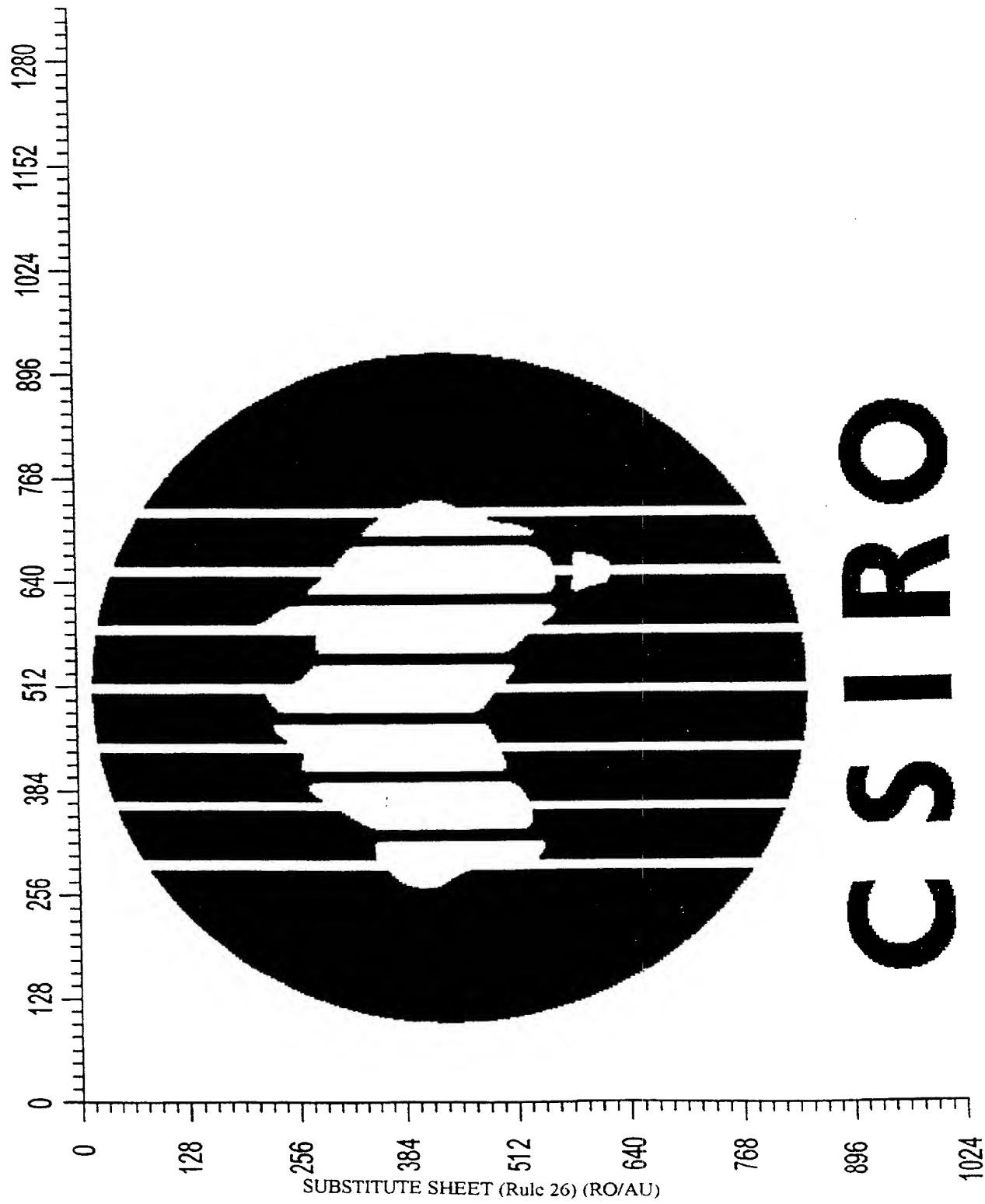
09/509649

WO 99/17941

PCT/AU98/00821

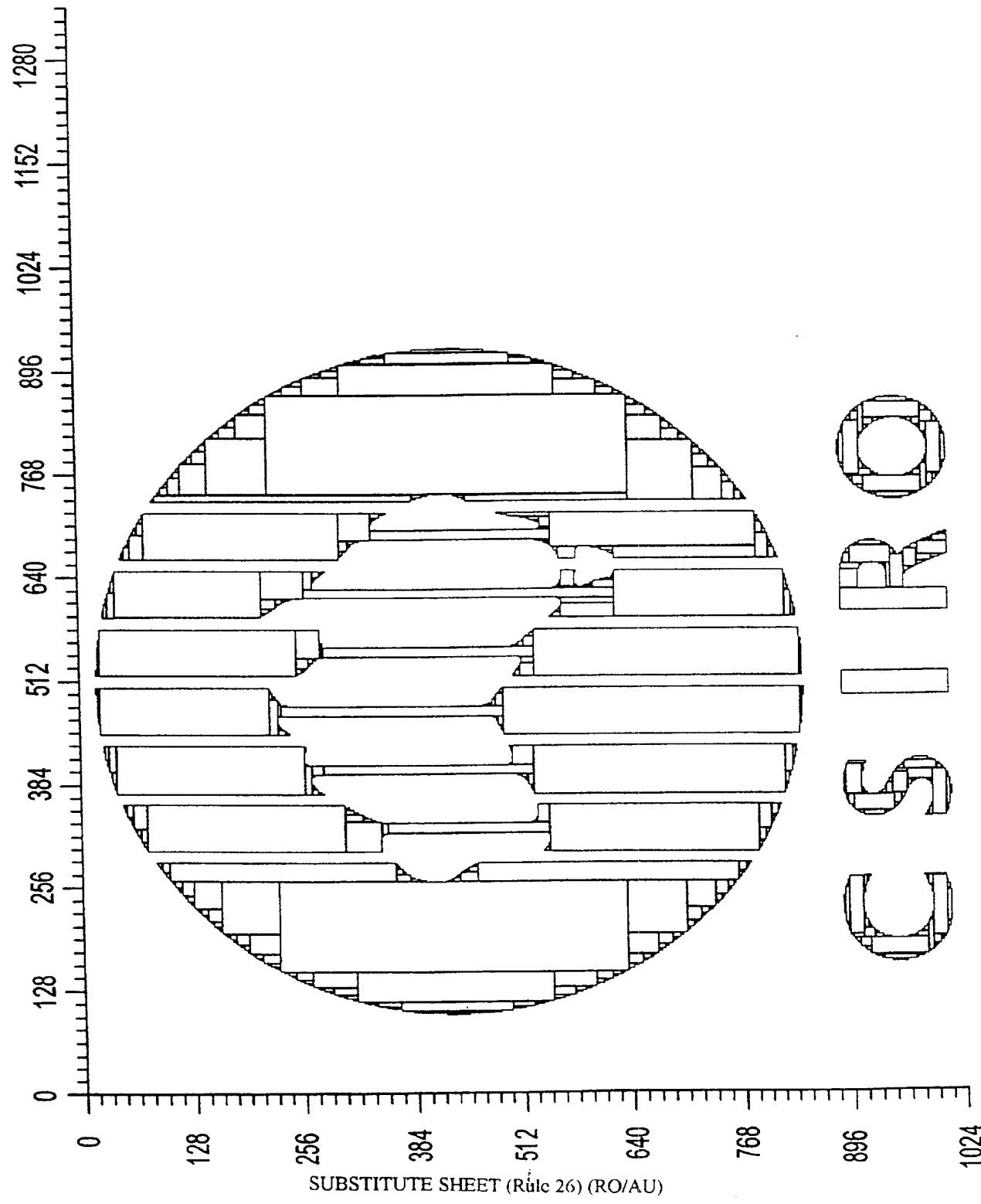
5/8

FIG 5



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FIG 6



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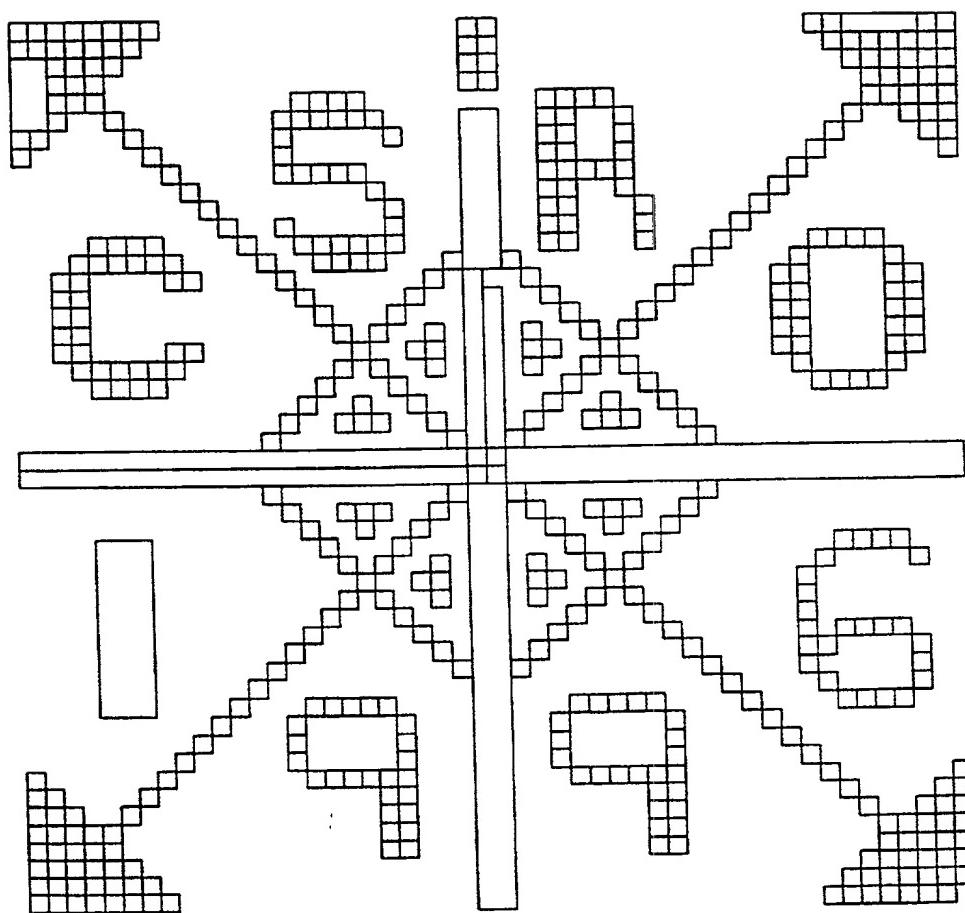


FIG 7

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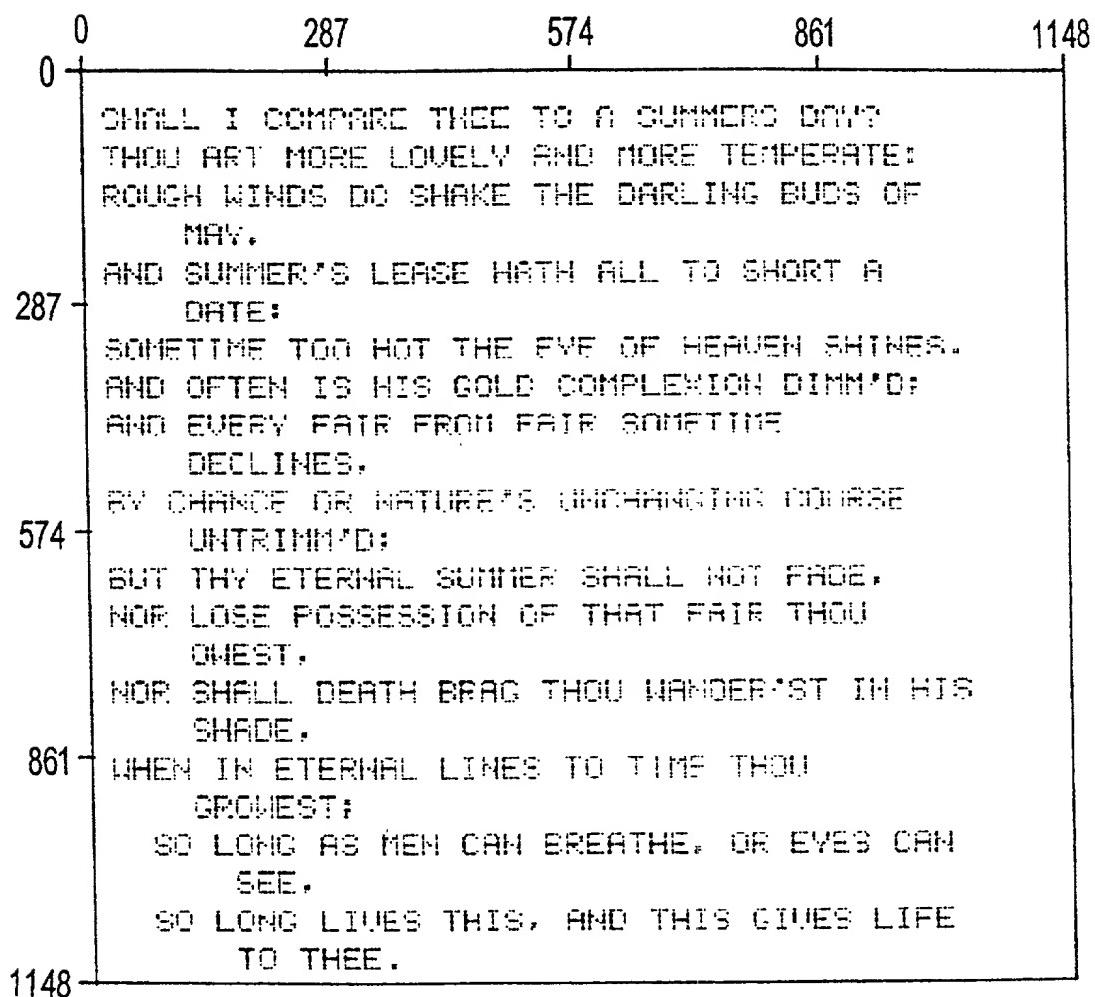


FIG 8

Attorney's Docket No. _____

COMBINED DECLARATION AND POWER OF ATTORNEY
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION, OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

- original
- design
- supplemental

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- national stage of PCT

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION, OR CIP.

- divisional
- continuation
- continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: *If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.*

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

MICROGRAPHIC DEVICE

SPECIFICATION IDENTIFICATION

the specification of which: (complete (a), (b) or (c))

- (a) is attached hereto.
- (b) was filed on _____ as [] Serial No. 0 / _____
or [] Express Mail No., as Serial No. not yet known, _____
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

- (c) was described and claimed in PCT International Application No. PCT/AU98/00821
filed on 30 September 1998 as amended under PCT Article 19 (1)
on _____ (if any).

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code Federal Regulations § 1.56.

[] In compliance with this duty there is attached an information disclosure statement 37 CFR 1.97.

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign applications(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) [] no such applications have been filed.
(e) [x] such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (e), enter the details below and make the priority claim.

**EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN(S)) PRIOR TO THIS U.S. APPLICATION**

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
AUSTRALIA	P09572	2 October 1997	[x] YES [] NO
PCT	PCT/AU98/00821	30 September 1998	[x] YES [] NO
			[] YES [] NO
			[] YES [] NO
			[] YES [] NO

**ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN(S)) PRIOR TO THIS U.S. APPLICATION**

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (*List name and registration number*)

Richard P. Berg, Reg. No. 28,145
Colin P. Abrahams, Reg. No. 32,393
Mavis S. Gallenson, Reg. No. 32,464
Kam C. Louie, Reg. No. 33,008

(13)

Don A. Hollingsworth, Reg. No. 25,631
Ira M. Siegel, Reg. No. 28,907
Richard J. Paciulan, Reg. No. 28,248
John Palmer, Reg. No. 36,885

(check the following item, if applicable)

[] Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

c/o LADAS & PARRY
5670 Wilshire Boulevard, Suite 2100
Los Angeles, California 90036-5679

(213) 934-2300 Ext.

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

Full name of sole or first inventor ROBERT ARTHUR LEE

Inventor's signature Robert Arthur Lee

Date 24/12/2000 Country of Citizenship AUSTRALIA

Residence 13 Wilkinson Street, East Burwood, Victoria, 3151, Australia ANX

Post Office Address As noted above

Full name of second joint inventor, if any GRAHAM LEWIS QUINT

Inventor's signature Graham Lewis Quint

Date 11/3/00 Country of Citizenship AUSTRALIA

Residence 26 West Street, Preston, Victoria, 3072, Australia ANX

Post Office Address As noted above

Full name of third joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship _____

Residence _____

Post Office Address _____

CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED PAGES(S)
WHICH FORM A PART OF THIS DECLARATION

- [] Signature for third and subsequent joint inventors. *Number of pages added* _____
- [] Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor
Number of pages added _____
- [] Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47
Number of pages added _____

- [] Added pages to combined declaration and power of attorney for divisional, continuation-in-part (CIP) application.
Number of pages added _____

- [] Authorization of attorney(s) to accept and follow instructions from representative.

If no further pages form a part of this Declaration then end this Declaration with this page and check the following item.

- [X] This declaration ends with this page.

C A M P T O P

DOCKET: CU-2137

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: Robert Arthur LEE et al)
TITLE: MICROGRAPHIC DEVICE)
COMPLETION OF PCT/AU98/00821 filed 30 September 1998)

The Assistant Commissioner for Patents
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATE ATTORNEY

Dear Sir:

The undersigned Attorney for Applicant in the above identified application for Letters Patent, hereby appoints individually and collectively as my Associate Attorneys, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent & Trademark Office connected therewith:

Thomas F. Peterson, Reg. 24790
Richard J. Streit, Reg. 25765
Timothy J. Keefer, Reg. 35567
Dennis K. Scheer, Reg. 39356
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3/30/2000

Date

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